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# THE NORTHERN FOREST FIRE LABORATORY

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a research unit of  
INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION  
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE  
OGDEN, UTAH

". . . dedicated to the development of knowledge for the protection and wise use of America's forest heritage . . ."

". . . research is a new force in the Nation today. It can provide a solution to an old problem — forest fires."





Photo: Ernst Peterson

Saddle Mountain fire. Montana, 1960.

## **FIRE RESEARCH IN AMERICA'S FOREST FUTURE**

Uncontrolled fire is a prime enemy to full use and enjoyment of American forests for wood, water, forage, recreation, and wildlife. Protecting forests from fire requires marshaling of the full technical resources of the Nation. These technical resources must stem primarily from a creative fire research program that feeds knowledge, ideas, and techniques to the firefighting agencies. The Northern Forest Fire Laboratory has been established for this express purpose.

# TARGETS . . .

## FOR FOREST FIRE RESEARCH

● **FIRE HAZARD REDUCTION.** How can we “fireproof” dangerous areas? Can research develop fire hazard reduction techniques using chemicals? —mechanical fuel chippers?—new forestry methods?

● **MAN-CAUSED FIRES.** How can we reduce the number of man-caused fires while forests are receiving constantly intensified use? Can research improve fire prevention by pinpointing best spots, times, and methods for preventive action?

● **LIGHTNING-CAUSED FIRES.** How can we develop better methods for controlling the thousands of lightning fires that burn annually in western forests? Can research show where and when lightning fires are most likely to start? — develop methods for reducing severity and numbers of lightning fires by weather modification?

● **FIRE DETECTION.** How can we rapidly and accurately locate and map fires obscured by darkness or dense smoke? — Can research improve fire detection by developing new techniques for using radar, infrared heat sensors, and airborne electronic scanning systems?

● **FIRE BEHAVIOR.** What transforms little fires into big ones? What makes some fires “blow up”? Can research develop better methods for measuring effects of weather on fire behavior? — for rating flammability of fuels? — for predicting the influence of topography? — for making firefighting safer?

● **FIRE SUPPRESSION.** How can men, machines, and materials be used more effectively and economically in firefighting? Can research improve fire suppression through development of chemical agents? — mechanized attack? — new concepts of air and ground attack?

● **USING FIRE BENEFICIALLY.** How can controlled fire be used as a beneficial tool in forestry? Can research develop better techniques for burning logging slash? — for removing unwanted vegetation? — for using fire to prepare seedbeds?



# ROLE of the NORTHERN FOREST FIRE LABORATORY

In the national program of forest fire research the Northern Forest Fire Laboratory has two broad missions:

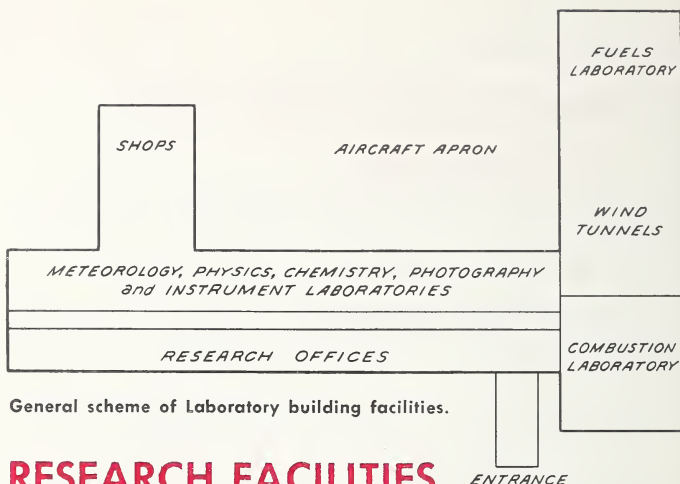
- *To perform basic and applied research on critical fire problems having nationwide interest.*
- *To conduct special regional research on fire problems peculiar to the Intermountain West and Alaska.*

The research program at the Northern Forest Fire Laboratory is coordinated with programs at the Forest Service Fire Laboratories at Macon, Georgia, and Riverside, California. The Northern Forest Fire Laboratory furthers close working relations with all fire research units at the several Forest Service Experiment Stations and also promotes research programs in conjunction with private, State, and Federal agencies, universities, and specialized scientific organizations.

All these programs, singly and collectively, aim toward discovery of basic information and development of techniques, equipment, and materials that will increase effective protection of all forest lands from fire.

**PREVENTION OF A SINGLE MILLION-DOLLAR FOREST FIRE THROUGH USE OF RESEARCH REPAYS THE ENTIRE COST OF THE LABORATORY. OVER THE YEARS, THIS INVESTMENT IN RESEARCH WILL PAY A RICH DIVIDEND BY LOWERING THE COSTS OF FIRE SUPPRESSION AND REDUCING LOSSES CAUSED BY FIRE.**

Research is our best hope for preserving today's forests for tomorrow's users.



General scheme of Laboratory building facilities.

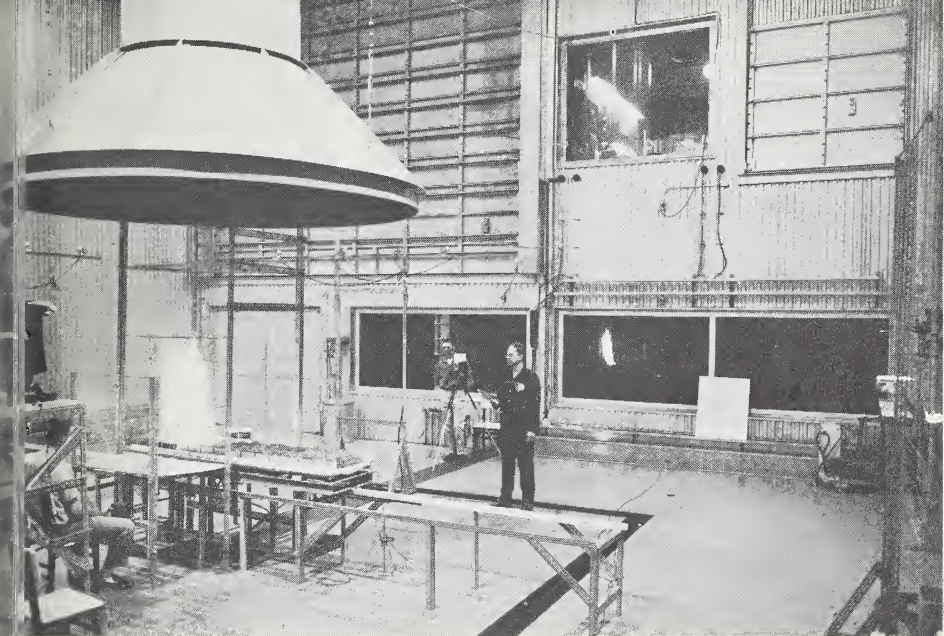
## RESEARCH FACILITIES

Technical facilities in the Northern Forest Fire Laboratory are designed specifically to aid research in the many complex problems associated with forest fires.

One entire wing of the Laboratory is specially equipped for research in fire physics and fire behavior. These facilities permit exacting studies of the physical and chemical characteristics of forest fuels and the characteristics of fires in these fuels under environmental conditions that may be varied and controlled. A viewing room overlooking the combustion laboratory permits forest officer-training classes to observe demonstrations of fire behavior and fire control.

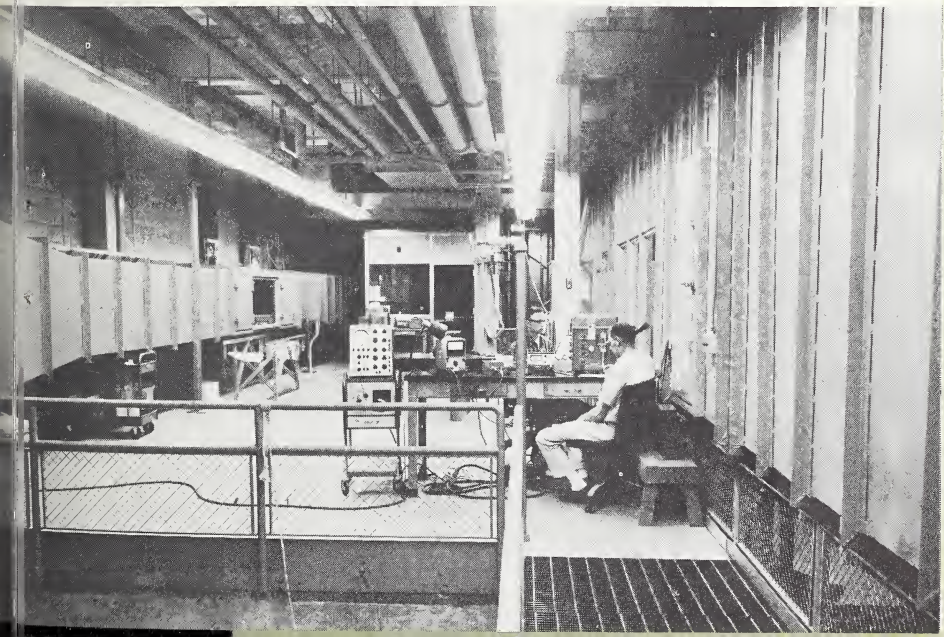
Laboratories in the main building contain equipment designed for research in fire prevention, detection, suppression, and forest fire meteorology. Electronics laboratories prepare and maintain specialized instruments for all fire research projects. A technical library provides reference books, bulletins, and periodicals on all phases of fire science. Other facilities include research equipment shops, a photography laboratory, and offices for the fire research staff.

In forest areas near Missoula, special field facilities are maintained for the support of forest fire research. On the Deerlodge National Forest near Philipsburg, Montana, a network of recording stations permits detailed studies of lightning storms. At the Priest River Experimental Forest in northern Idaho, facilities are available for a variety of fire research projects requiring field experimentation.



**COMBUSTION LABORATORY.** In the 66-foot-high tower, researchers study model fires burning under controlled air temperature, atmospheric pressure, and relative humidity.

**WIND TUNNELS.** High- and low-velocity wind tunnels make possible analytical studies of fire behavior and fire control in winds having regulated speeds up to 50 m.p.h. Air temperature and relative humidity are also controlled for wind tunnel studies.

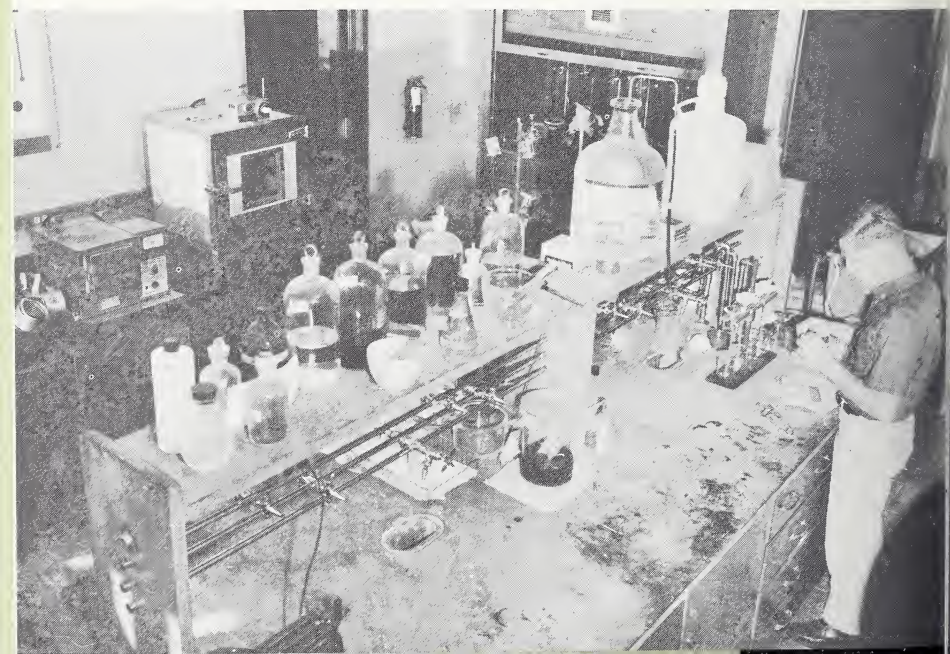






**FUELS LABORATORY.** The varied fuels found on forest and range lands—leaves, needles, grass, bark, tree limbs, and twigs—are analyzed here. A controlled environmental chamber enables scientists to subject fuels to cycles of typical weather conditions.

**PHYSICS AND CHEMISTRY LABORATORIES.** Besides analyzing physical and chemical characteristics of forest fuels, technicians can study chemical suppression agents for aerial and ground attack on fires.





**WEATHER RADAR.** The U. S. Weather Bureau radar station on 8,000-foot Point 6 Mountain above the Laboratory scans lightning storms and other atmospheric phenomena over a radius of 250 miles. Signals from the radar are transmitted by microwave to the Weather Bureau Airport Station and from there by coaxial cable to auxiliary scopes in the Fire Laboratory.

**METEOROLOGY LABORATORY.** Research meteorologists use radar scope information as an aid in detecting, tracking, and analyzing the characteristics of lightning storms, which are the greatest single cause of fires in western forests.







## LOCATION

Location of the Northern Forest Fire Laboratory adjacent to the Missoula airport and in a great forest region is ideal for forest fire research. It places the Laboratory close to facilities and in an environment constantly needed in the varied phases of fire research. These include:

- **FIRE REGION.** The Northern Forest Fire Laboratory is literally surrounded by millions of acres of forests that pose a variety of difficult problems in protection and fire control. Rugged mountains, vast areas of flammable forests, and a wide variety of weather conditions constantly challenge the skill and endurance of pilots, smokejumpers, and ground firefighting crews. Summer weather in the area is characterized by numerous lightning storms that start hundreds of blazes every season. This challenges creative research aimed at solution of critical fire problems.

- **MISSOULA COUNTY AIRPORT.** Aircraft are used extensively in fire research. The entire facilities of the airport — taxiways to the door of the Laboratory, aircraft service companies, commercial airlines, and Federal aviation services — all combine to facilitate forest fire research.



● **U. S. FOREST SERVICE AERIAL FIRE DEPOT AND SMOKEJUMPER CENTER.** Logistic support and practical field trials of forest fire research are major contributions stemming from the adjacent facilities of the Region 1 Division of Fire Control. Smokejumpers, airplane pilots, fire staffmen, and radio engineers are important partners of the fire laboratory.

● **U. S. FOREST SERVICE EQUIPMENT DEVELOPMENT AND TESTING CENTER.** This center at Missoula, operated by National Forest Administration, develops and tests a variety of tools and equipment for forestry. It serves the entire U. S. Forest Service and has developed many items now used by the armed services as well as forestry agencies throughout the Nation.

● **U. S. WEATHER BUREAU.** As part of a cooperative interagency program, the headquarters of the Western Fire Weather Coordinator for the U. S. Weather Bureau is maintained at the Laboratory. Weather Bureau facilities at the nearby airport station provide facsimile weather maps, meteorological data, and 24-hour teletype service for use in fire research. Radar scopes in the Fire Laboratory are provided by the U. S. Weather Bureau.

● **REGIONAL FIRE AGENCIES.** The Missoula area contains many fire agencies including the Montana State Forestry Department, Bureau of Land Management, Indian Service, and private timber protective associations. Nearby are several National Parks as well as the largest concentrated area of National Forests in the United States. All are co-operators and customers of forest fire research.

● **UNIVERSITIES.** Forestry colleges and science departments at universities in the Western States and especially at Montana State University offer many opportunities for strong cooperative support of the fire research program.

# THE FIRE SCIENCES

Many scientific disciplines contribute to success of the program at Northern Forest Fire Laboratory. Our research staff includes men and women with professional training and experience in several sciences. The contribution of these sciences is sketched below.

● **FORESTRY.** Knowledge of the science of forestry and of its many technical disciplines is fundamental to designing, performing, and evaluating research projects aimed at fire prevention and control. Many of our staffmen hold college and advanced degrees in forestry.

● **MATHEMATICS.** Thorough grounding in mathematics is fundamental to competent application of physical, biological, and engineering sciences to problems in fire research. Statistics and advanced mathematics have special importance in many phases of our program.

● **PHYSICS.** Analysis of behavior of model fires under controlled atmospheric and fuel conditions rests on application of principles of physics. The relation of variables that govern ignition, buildup, and spread of fires can be determined and understood only by application of physical principles. This is equally true for studies of weather phenomena.

● **CHEMISTRY.** Analysis of fuel components and development of fire retardant materials rely heavily on application of chemistry principles and techniques.

● **METEOROLOGY.** Forest fire meteorology concerns the specific relations of the atmosphere and local weather to the ignition, spread, and control of fires. We expect basic studies in meteorology to reveal what characteristics of lightning storms influence occurrence and behavior of lightning fires and whether lightning fire danger can be reduced by techniques of weather modification.

● **ENGINEERING.** The study of combustion, the development of firefighting methods, and the operations of research facilities all involve many phases of mechanical, electronic, and forestry engineering sciences.

# RESEARCH ORGANIZATION

The Northern Forest Fire Laboratory is staffed by the Division of Forest Fire Research of the Intermountain Forest and Range Experiment Station. The Chief of the Division of Forest Fire Research, Missoula, Montana, is responsible to the Director of Intermountain Station, Ogden, Utah, for planning and supervision of the research program and for overall leadership at the Laboratory. The Division Chief is assisted by research project leaders and their staffs. The functions of the research projects are outlined below.

- **PROJECT SKYFIRE.** Research is aimed at the prevention and control of lightning-caused fires in the western United States. Studies include characteristics of lightning storms and fires resulting from them, atmospheric physics, and modification of lightning storms through cloud seeding.

- **FIRE CONTROL SYSTEMS.** Research is directed toward development of fire control systems, methods, and techniques adapted to the climatic, fuel, and topographic conditions of the Mountain West. Studies include electronic fire detection, fire suppression (firefighting chemicals), and prescribed use of fire.

- **FIRE PHYSICS.** Research is concentrated on the fundamentals of combustion in forest and range fuels. Studies include the mechanisms of fire spread and fire aerodynamics.

- **FIRE BEHAVIOR.** Scientists are evaluating different combinations of weather, fuels, and topography and developing systems for predicting fire behavior in these situations. Studies include the physical and chemical characteristics of fuels, fire environment, fire-danger rating, and fire behavior evaluation and prediction.

- **RESEARCH SERVICES.** The research program at the Fire Laboratory is supported by administrative and technical service specialists, who handle the details of business management and laboratory operation and maintenance.

## RESEARCH RESULTS

● **PUBLICATIONS.** Fire research results are published in various technical and professional journals, USDA bulletins, and as Forest Service research papers and notes. A limited supply of publications is maintained at the Fire Laboratory for professional visitors. Persons desiring to receive fire research publications distributed by Intermountain Station should request them from:

Director, Intermountain Forest and  
Range Experiment Station  
U. S. Forest Service  
Ogden, Utah 84403

● **SEMINARS AND TRAINING MEETINGS.** As research on projects progresses, the Northern Forest Fire Laboratory periodically holds seminars, demonstrations, and training meetings, for the benefit of forestry agencies and interested scientists.





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RESEARCH CAN MEAN THE DIFFERENCE







